# AnDAPT

## Features

- PWM, current mode, point-of-load (POL) regulator
- Maximum output current: Defined by selected device 1A=AmP8D1, 3A=AmP8D3, 6A=AmP8D6
- Vin: 3.0 to 13.2 V, Vout: 0.6V to 5.5V
- Adjustable output voltage with down to 1.2 mV resolution
- Integrated MOSFETs, $R_{DS(on)}$: 40mΩ
- 1% typical line and load regulation
- Efficiency up to 95%
- Internal single pole compensator minimizes external part count
- Analog slope compensation
- Adjustable switching frequency
- Additional capabilities – see I100, P100
- Adaptable stability, bandwidth, gain & phase margin
- Frequency synchronization: adjustable up to 2000 kHz
- Adjustable protection: Under-Voltage Lockout, (UVLO), Overcurrent (OCP), Overvoltage (OVP), and Over Temperature (OTP)
- Short-circuit protection (SCP)
- Power-good flag output and Enable input
- Soft start/stop, sequencing, pre-bias startup
- 52-, 58-, or 74-pin VQFN package
- –40°C to +125°C operating junction temperature
- Two SIM elements; integrate up to six C100 Power Components in one AmP platform
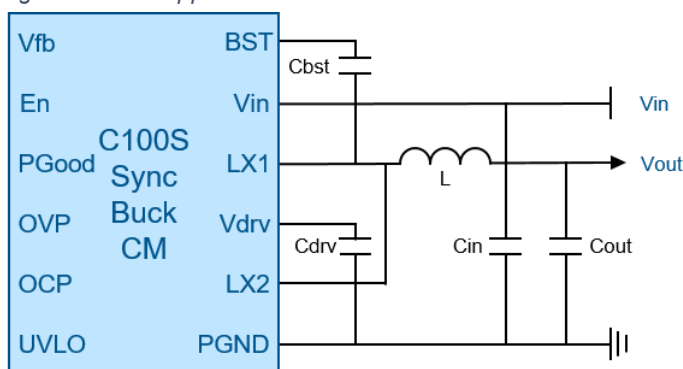
## Applications

- On-demand power management, multi-rail power integration
- Powering server, processor, memory, storage, network switcher and router platforms
- FPGA, processor, SSD, subsystem power control & sequencing

## Typical Application Circuit

Figure 1 provides a typical schematic for the C100 Power Component when integrated with other power rails in an AmP application.

*Figure 1: C100 application schematic*



## Description

The C100 Power Component is a customizable PWM Synchronous Buck, Current Mode Switching Regulator. Combine the C100 component with other Power Components to create a custom-defined, AnDAPT AmP on-demand power management device.

The integrated, low-resistance switching Scalable Integrated MOSFETs (SIMs) provide up to 6A output current. The maximum current is defined by the AmP device selected.

Output voltage feedback is compared against an internal reference using a high-performance, voltage-error amplifier that provides tight voltage regulation accuracy under transient conditions. Pulse-width modulated (PWM), current-mode regulation is implemented with PID and slope compensation. The switching frequency is either generated internally via an oscillator with selectable frequencies or provided via an external pin. The C100 component has a customizable current switchover point between pulse-width modulation (PWM) for higher-current loads and pulse-skipping modulation (PSM) for low-current loads.

The customizable output voltage is specified by the power engineer during customization using AnDAPT's cloud-based WebAmp development software. The C100 component has customizable control and status pins including an optional enable input, an optional power-good output, and optional output flags to signal when the system triggers an overvoltage (OVP), overcurrent (OCP), or undervoltage lockout (UVLO) condition. The threshold values are specified by the power engineer using the WebAmp tool.

The customizable soft-start and soft-stop slew rates plus ramp timing are also specified by the power engineer using the WebAmp tool.

## Customizable Options

Table 1 lists the various customizable options available for the C100 Power Component.  These options are set graphically in the WebAmp development software.

*Table 1: C100 Customizable Options*

| Option | Units |
|---|---|
| Switching frequency | kHz |
| Input voltage | V |
| Output voltage | V |
| Ripple, % of output voltage* | % |
| Ripple, % of maximum output current* | % |
| Use optional En input to enable supply | On/Off |
| Use optional UVLO output to signal that output voltage is in under-voltage lockout condition | On/Off |
| Input voltage threshold for under-voltage lockout | V |
| Use optional OVP output to signal when over-voltage protection is triggered | On/Off |
| Over-voltage protection threshold | V |
| Use optional OCP output to signal when over-current protection is triggered | On/Off |
| Over-current protection threshold | A |
| Delay after enable to soft start | ms |
| Soft start rise time after enable | ms |
| Soft stop delay after disable | ms |
| Soft stop fall time after initial delay after disable | ms |
| Use optional PGood output to signal "power good" | On/Off |
| "Power good" threshold, percentage of output | % |
| Delay from "power good" until PGood asserted | ms |
| PID regulation coefficients ($K_P$, $K_I$, $K_D$) | |
| Threshold to switch between pulse-skipping mode (PSM) and pulse-width modulation (PWM) | A |

* to generate passive component recommendations

## Package Options

Table 2 lists the package options available for the C100 Power Component.  Typically, multiple AnDAPT power components are integrated into a single package.

*Table 2: Package Options for C100*

| Pins | Dimension | SIM Bonding | Part Number |
|---|---|---|---|
| 52 | 6 x 6 mm | Paired | C100P |
| 58 | 7 x 7 mm | Paired | C100P |
| 74 | 8 x 8 mm | Single | C100S |

## Advanced Capabilities and Options

Table 3 lists derivatives of the C100 component with additional capabilities plus other similar components potentially suitable for this application.

*Table 3: C100 Advanced Capabilities Options*

| Description | Part Number |
|---|---|
| Standard Pro Series version (this component) | C100 |
| Add external control via I²C bus interface | I100 |
| Add telemetry and dynamic voltage scaling via DVS interface | P100 |
| Single-phase buck regulator, synchronous, PWM, voltage mode regulation | C200 |
| Single-phase buck regulator, asynchronous, PWM, voltage mode regulation | C250 |
| Multi-phase buck regulator, synchronous, PWM, current mode regulation | C510 |

## System Characteristics

Table 4 lists the system characteristics for the C100 Power Component when implemented in an AnDAPT AmP device.

*Table 4: C100 System Characteristics*

| Parameters | | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| **Power** | | | | | |
| Bias Supply Voltage ($V_{BIAS}$) | | 6 | | 13.2 | V |
| Input Drain Voltage ($V_{IN}$) | | 3 | | 13.2 | V |
| Output Voltage ($V_{OUT}$) | | 0.6 | | 5.5 | V |
| Output Current ($I_{OUT}$) | D6 | | | 6 | A |
| | D3 | | | 3 | |
| | D1 | | | 1 | |
| Switching frequency ($F_{SW}$) | | | | 2000 | kHz |
| Output MOSFET switch ($R_{DS(on)}$) | | | 40 | | mΩ |
| Load regulation ($\Delta V_{OUT}/\Delta I_{OUT}$) | | | 1 | | %/A |
| Line regulation ($\Delta V_{OUT}/\Delta V_{IN}$) | | | 1 | | %/V |
| Peak efficiency ($V_{IN}$=5V, $V_{OUT}$=3.3V, $F_{SW}$=500kHz) | | | 95 | | % |
| **Control** | | | | | |
| Over-/under-shoot | | | ±5 | | % |
| Dynamic MOSFET current per segment | | | 0.37 | | A |
| Soft start/stop delay | | 2 | | 10 | ms |
| Current Limit – OCP | | 0.2 | | 6 | A |
| Overvoltage protection trip point range (OVP) | | 0 | | 5.5 | V |
| Undervoltage lockout start threshold range (UVLO) | | 0 | | 5.5 | V |

For other device specifications, see the AnDAPT AmP Platform datasheet.

## Additional Resources

- AnDAPT AmP Platform datasheet